

## CLAIMS

What is claimed is:

1. A semiconductor device configured to sense a property of a medium, the device comprising:  
a contact; and  
a sensing layer disposed below the contact, wherein the sensing layer is exposed to the medium in an area below the contact.
2. The device of claim 1, wherein the contact includes at least one perforation for exposing the sensing layer to the medium.
3. The device of claim 2, wherein the at least one perforation comprises an area in the range from approximately one square nanometer to approximately ten square centimeters.
4. The device of claim 1, further comprising at least one additional contact.
5. The device of claim 1, wherein the device is configured to operate as a field effect transistor and wherein the contact comprises a gate contact.
6. The device of claim 5, wherein the field effect transistor comprises a compound semiconductor field effect transistor.
7. The device of claim 1, wherein the property comprises a pH level.

8. The device of claim 1, further comprising a dielectric layer disposed between the contact and the sensing layer.

9. The device of claim 8, wherein the dielectric layer includes at least one perforation for exposing the sensing layer to the medium.

10. The device of claim 1, wherein the sensing layer comprises at least one of: a semiconductor layer and a dielectric layer.

11. A field effect transistor (FET) configured to sense a property of a medium, the FET comprising:

a source contact;

a drain contact;

a gate contact, wherein the gate contact defines a gate area disposed below and adjacent the gate contact; and

a sensing layer for sensing the property, wherein the sensing layer is disposed below the gate contact and wherein the sensing layer is exposed to the medium in the gate area.

12. The FET of claim 11, wherein the gate contact includes at least one perforation.

13. The FET of claim 11, further comprising a dielectric layer disposed between the gate contact and the sensing layer.

14. The FET of claim 13, wherein the dielectric layer includes at least one perforation in the gate area.

15. The FET of claim 11, wherein the sensing layer comprises a dielectric layer.

16. A semiconductor device configured to sense a property of a medium, the device comprising:
- a contact that includes at least one perforation to expose a sensing layer to the medium;
  - a dielectric layer disposed below the contact; and
  - an active structure disposed below the dielectric layer, wherein the sensing layer comprises at least one of: the dielectric layer and a semiconductor layer in the active structure.
17. The semiconductor device of claim 16, wherein the dielectric layer includes at least one perforation.
18. The semiconductor device of claim 16, wherein the property comprises pH.
19. The semiconductor device of claim 16, wherein the device is configured to operate as a field effect transistor.
20. The semiconductor device of claim 19, wherein the contact comprises a gate contact.